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*Urocyon townsendi* Merriam, C. H.  
*Procyon* near *lotor* Linn.  
*Felis hippocetes* Merriam, C. H.  
*Mephitis occidentalis* Baird.  
*Mustela* sp.  
*Aplodontia* near *major*.  
*Erethizon epixanthus* Brandt.  
*Lepus auduboni* Baird.  
*Lepus* sp.  
*Microtus* sp.  
*Neotoma fuscipes* Baird.  
*Neotoma* sp.  
*Sciurus* sp.  
*Citellus douglasi* Richardson.  
*Euceratherium collinum* Sinclair & Furlong.  
*Euceratherium* n. sp.  
*Odocoileus* sp. (a).  
*Odocoileus* sp. (b).  
*Megalonyx* sp.

The majority of the remains discovered are those of large carnivora or of cave-inhabiting rodents. This would indicate that these animals have lived in the caves. Such evidence is supported by the fact that the remains of ungulates and other forms which would naturally fall prey to the carnivora are generally much scattered and broken, and in some instances show marks of carnivore teeth.

The position of the present entrance precludes the supposition that any animal could by means of it have gained entrance to this chamber. It is seventy-five feet above the cave floor with a straight drop from top to bottom. The approach to this chimney is through several difficult and tortuous galleries, a route which animals would not follow, as it is far from the light.

Under a portion of the overhanging wall at the southwest side of chamber two, a small fan of stalagmite-covered detrital matter sloping from the outside may mark a former entrance now entirely choked and sealed by the heavy stalagmite growth. It was possibly at this point that animals had access to the chamber, as there is now no outside entrance.

A full report on this investigation will appear later in the Publications of the University of California.

E. L. FURLONG.

UNIVERSITY OF CALIFORNIA,  
 April, 1904.

VITALITY OF *PSEUDOMONAS CAMPESTRIS* (PAM.)  
 SMITH ON CABBAGE SEED.

BLACK rot of cabbage and cauliflower, caused by *Pseudomonas campestris* (Pam.) Smith, is a widespread and often destructive disease in the United States. The experience of farmers indicates that the disease may be transmitted by means of the seed; but plant pathologists have doubted this because it seemed impossible that the organism could retain its vitality for several months on dry seeds. *P. campestris* forms no spores. Moreover, Russell and Harding\* found that when fresh bouillon cultures were dried at 29° C. on cover slips and kept in darkness 'an exposure of 45 hours invariably sufficed to destroy the vitality of the organisms.'

Recently the writers have investigated this subject and find that *P. campestris* may live on dry cabbage seed for at least ten months. A quantity of cabbage seed was wet with water into which a culture of *P. campestris* had been thoroughly stirred. The seed was then dried and stored in test-tubes in darkness. Some tubes were simply plugged with cotton, while others were plugged with cotton and then sealed with paraffin. Once a month the seeds were tested for the presence of living germs of *P. campestris*. This experiment is unfinished; but at the end of ten months some live germs were found (both in paraffined and in unparaffined tubes) and healthy cabbage plants inoculated with these germs showed the characteristic lesions of black rot in from one to three weeks.

The writers have also proved that germs of *P. campestris* actually do occur on cabbage seed. Four black-rot-infected seed-cabbage plants from Long Island were threshed separately and the seed rinsed in sterile water. Cultures of this water showed the presence of *P. campestris* on three lots of seed. The identity and pathogenicity of these cultures were proved by inoculations into plants. Other portions of the water were injected directly into plants and black rot produced in six out of twelve cases. On combining the re-

\* Russell, H. L., and Harding, H. A., 'A Bacterial Rot of Cabbage and Allied Plants,' Wis. Agr. Exp. Sta. Bul. 65: 19.

sults of the two methods the presence of *P. campestris* is shown on the seeds of all four of the seed plants examined.

Full details of these studies will soon appear in Bulletin No. 251 of the New York Agricultural Experiment Station.

H. A. HARDING,  
F. C. STEWART.

GENEVA, N. Y.

A NOTABLE PALEOBOTANICAL DISCOVERY.

THE term Cycadoflices proposed by Potonié for the group of synthetic genera, which in Paleozoic times were abundant and widely distributed, and which so curiously combine filicinean and cycadean anatomical characters with foliar organs entirely fernlike in form, seems likely to become a permanent acquisition to taxonomy; although some students, following so eminent an authority as Zeiller, still regard the Cycadofliceales as merely a specialized group of ferns.

The announcement a few months ago\* by Professors Oliver and Scott that the gymnospermous seeds named by Williamson *Lagenostoma*, were borne by a species of *Lyginodendron* is most interesting. This identification is based on the identity of the capitate, often stalked, glands, which clothe the enclosing envelope, with those clothing the vegetative organs of *Lyginodendron Oldhamium*. These glands show the closest possible agreement in size, form and structure, and no other known Carboniferous plant possesses them. In addition, the vascular system of the enclosing cupule was well developed, the structure of the large bundle agreeing with the petiolar strand in *Lyginodendron*; and the minute characters in the former are in close agreement with those of the xylem of the foliar organs of the latter, so that the evidence presented is fairly conclusive.

Now *Lyginodendron* with a number of species under a variety of names ranges from the lower Carboniferous into the Permian. The calcified remains, often beautifully preserved and including roots (*Kaloxylon*), stems (*Lyginodendron*) and leaves (*Sphenopteris*) have been associated with the carbonaceous

\* Read before the Royal Society, May 7, 1903, and reprinted from the *Proceedings*.

impressions of large finely divided fronds of the *Sphenopteris* type.

The minute structure of these parts is as well known as in living forms, as are the corresponding structures in *Heterangium*, another genus, considered in a general way ancestral to *Lyginodendron* and exhibiting a balance of filicinean characters; while in the latter, though many filicinean characters remain, the cycadean features are more pronounced, the primary bundles are isolated and arranged around a large pith, the vascular bundles both primary and secondary are similar to those of the peduncles in living cycads, and the roots, while agreeing with those of the Marattiaceæ when young, after their secondary thickening are entirely gymnospermous.

The fructifications of this curious plant have hitherto remained unknown, although certain poorly preserved filicinean remains of the *Calymmatotheca* type have been so regarded.\*

The structure of the seed as now set forth furnishes a preponderance of gymnospermous features, at the same time emphasizing the combination of transitional characters which distinguish the Cycadofliceales, and furnishes good ground for supposing that many of the plants which furnished the elegant fronds of *Alethopteris*, *Neuropteris*,† *Sphenopteris*, etc., had already advanced in seed, bearing as far as, if not farther than, the modern Cycads.

The seed under consideration, as does the similar one of *Lagenostoma ovoides*, approaches the cycadean type in that the integument and nucellus are distinct in the apical region only, where the former becomes massive and complicated, consisting of nine chambers radiating from the micropyle. The free portion of the nucellus tapers upward reaching the exterior and plugging the micropylar opening; the separation of the nucellar epidermis from the underlying parenchymatous body of the free part of the nucellus forms a bell-shaped

\* Described by Benson (Ann. Bot. 18: 161-177, pl. 11, 1904) and regarded as the microsporangial sori of *Lyginodendron*.

† In a recent note Professor Oliver (New Phytologist, 4: 32, 1904) records seeds on the fronds of *Neuropteris heterophylla*.